## *Autumn Examinations 2016/ 2017*

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| **Exam Code(s)** | 4BCT1 |
| **Exam(s)** | 4th Year Examination Computing Science and IT |
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| **Module Code(s)** | CT421 |
| **Module(s)** | Artificial Intelligence |
| | |
| Paper No. | 1 |
| Repeat Paper | No |
| | |
| External Examiner(s) | Dr. John Power |
| Internal Examiner(s) | Dr. M Schukat |
| | *Dr. C Mulvihill |
| | *Dr. F Smith |

**Instructions:** Answer 2 questions from each section. All questions will be marked equally. Use a separate answer book for each section.

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|---|---|
| *Duration* | 2 hours |
| **No. of Pages** | 3 |
| **Discipline(s)** | IT |
| **Course Co-ordinator(s)** | |

**Requirements**:

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|---|---|
| MCQ | Release to Library: Yes ☐ No ☐ |
| Handout | None |
| Statistical/ Log Tables | None |
| Cambridge Tables | None |
| Graph Paper | None |
| Log Graph Paper | None |
| Other Materials | None |
| Graphic material in colour | Yes ☐ No ☐ |

**PTO**

## Section A

1

(a)

Why can fuzzy rule systems have fewer rules than conventional rule based systems?
 (5 marks)

(b)

What is meant by membership of a fuzzy set? Illustrate you answer with an example,.
 (5 marks)

(c)

> (i) Define fuzzy sets that describe the humidity in a room. There should be three sets, Low, Medium and High with a suitable overlap between them. (8 marks)
>
> (ii) Use these sets to illustrate how 3 different levels of humidity match these three sets (7 marks)


2

a) What are the differences between Quantitative and Qualitative representation? Highlight the advantages of qualitative representation
   (10 marks)

b) Describe how MYCIN handles uncertainty. Illustrate your answer with an example.
   (9 marks)

c) How can the Turing test be used .to determine if an AI possesses intelligence?
   (6 marks)


3

(a)

How does AI search differ from conventional search?
 (5 marks)

(b)

Describe heuristic search. Highlight how it differs from both depth first and breadth first search.
(9 marks)

(c)

Describe the difference between forward and backward chaining. For both forms of reasoning, give the conditions that best suit it.
 (6 marks)

(d)

Describe 5 sources of uncertainty that could arise in reasoning systems.
 (5 marks)

**PTO**

4

    (a)  What do you understand by a 'greedy searcher?' (7 marks)

    (b) Greedy searchers are often employed with graphs.  Consider an undirected graph G that consists of six nodes and six edges as follows: A is connected to D and F. B is connected to C and E. C is connected to B and F. D is connected to A and E. E is connected to B and D. F is connected to A and C. Find one ordering of the vertices where a greedy searcher will colour the vertices with two colours, and another where it will colour with three colours. Note:  The conditions on the search are that connected nodes must have different colours and that the least possible number of colours is preferred (12 marks)

    (c) Outline any one application area where a greedy searcher might be useful (6 marks)

5

    (a)  In the context of genetic algorithms, explain what is meant by the term 'fitness function' (5 marks)

    (b)  A software bot (like Mitchell's Robby) is to be developed for collecting cans in a 10 by 10 two-dimensional array. A cell of this array can be empty or contain a can. In terms of context, a bot can see the contents of the current cell, and the contents of one cell north, south, east and west. In terms of actions, a bot can: Move one cell north, south, east, west, move one step randomly (north, south, east, or west), pick up a can in the current cell, or do nothing. A reward should be given if the bot picks up a can in the current cell. However a fine should be applied if the bot's action is to pick up a can and there is in fact no can in the cell. Discuss the development of a suitable genetic algorithm for evolving this bot (12 marks)

    (c) Do genetic algorithms always find the best solution in your view? (8 marks)

6

"Watson presents a vision of the future for Artificial Intelligence, and systems like Siri and Alexa represent the current state of AI, at least from the perspective of everyday personal assistants" Discuss this statement under the following three headings: Current state of AI-based assistants (7 marks), high-end AI assistants (10 marks), future trends (8 marks)